Heli Kallioniemi

Elearning training in chemical industry

Metropolia Ammattikorkeakoulu
Insinööri (AMK)
Kemiantekniikka
Insinöörityö
10.8.2015

Metropolia

Tiivistelmä

Tekijä(t) Otsikko Sivumäärä Aika	Heli Kallioniemi eLearning –koulutukset kemianalan tuotannossa 28 sivua + 3 liitettä 10.8.2015
Tutkinto	Insinööri (AMK)
Koulutusohjelma	Kemiantekniikka
Suuntautumisvaihtoehto	Prosessitekniikka
Ohjaaja(t)	Timo Seuranen, opettaja Marjo Väänänen, manager BBA, polyolefins Innovation & Technology Borealis Polymers Oy

Työn tarkoituksena oli laatia Borealis Business Academyn järjestämien koulutusten kurssipalautteista koulutusyhteenveto sekä analysoida palautteet. Koulutusyhteenvedossa kurssipalautteet analysoitiin usealta eri kannalta ja laskettiin muun muassa kurssien ja kouluttajien saamat arvosanat sekä keskiarvot. Tulosten pohjalta tehtiin kehitysehdotuksia tulevaisuuden kurssien kehittämiseksi.

Teoriaosuudessa keskityttiin oppimisen ja opettamisen historiaan sekä tietokone- ja Internetpohjaisten koulutusten tyyleihin, kurssin rakentamisen vaiheisiin ja eLearningien kehitykseen. Työssä tutkittiin Internet-pohjaisen koulutuksen suunnittelua, sisällön ja teknisen toteutuksen vaatimuksia sekä kurssien järjestelmätason haasteita. eLearningien etuja ja haittoja pohdittiin saatujen kokemusten perusteella sekä arvioitiin tulevaisuuden suuntauksia ja mahdollisuuksia.

Avainsanat	Internet, eLearning, koulutus, koulutusyhteenveto

Abstract

Author(s) Title Number of Pages Date	Heli Kallioniemi eLearning trainings in chemical industry 28 pages + 3 appendices 10 August 2015
Degree	Bachelor of Engineering
Degree Programme	Chemistry
Specialisation option	Process technique
Instructor(s)	Timo Seuranen, Senior Lecturer Marjo Väänänen, Manager BBA, polyolefins Innovation & Technology Borealis Polymers Oy

The purpose of this thesis was to define learning and teaching strategies, to gather and analyse training feedback from Borealis internal trainings. Training feedback was gathered from Internet surveys that were created separately for each training from one year (2013-2014) period and analysed. Average grades for trainings were calculated for different course feedback criteria and trainer grades were calculated for both internal and external trainers. Also written feedback was gathered, analysed and communicated for the Borealis internal trainers. Improvement suggestions for trainings and training equipment were also made.

Research on learning and teaching concerning multimedia learning was made and types of eLearning were defined. The advantages and disadvantages of Internet-based training were studied and proposals for training content were made from both contextual and technical point of view. Also administrative and some resource prospects were considered and proposals were made. This thesis gathered some basic elements of different types of eLearning and studied the utilization of content as well the future considerations for eLearning.

Keywords	Multimedia, eLearning, training, Internet-based

Content

Abbreviations

HSE	Health, safety and environment
LDPE	Low-density polyethylene
PP	Polypropylene
PE or PE2	Polyethylene
BBA	Borealis Business Academy
TCM	Technical Competence Management
InnoTech	Innovation and Technology
LO	Learning objective
m-Learning	Mobile Learning
PDA	Personal Digital Assistant
ROI	Return of Investment
Telco	Teleconference
LO	Learning Objective
LMS	Learning Management Systems
KM	Knowledge Management

1 Introduction

The purpose of this thesis was to create an overall picture of Borealis' internal trainings and to study the different techniques of creating an excellent training. The theory part consists of different studying and pedagogical methods as well as Borealis' trainings are analysed with different tools. In the practical part of the thesis, an eLearning considering 'How to create good training in Borealis' was created and launched as well as training feedback was gathered and analysed from surveys.

1.1 History of Borealis

Borealis is a big market leader company providing polyolefins, base chemicals and fertilizers worldwide. Borealis was born due to the combination of Neste and Statoil cooperation in 1994. The name of the company refers to its Nordic roots and comes from a Latin word for "from the north." The company has its headquarters in Austria, Vienna and plants in many countries, in 120 to be precise, and employs as many as 6200 people. Borealis places extra focus on health, safety and environmental (HSE) issues and is an internationally well-known company in that area. Also, quality is highly being controlled by the quality organization that is joined with the HSE department. [1, p. 2-6]

The International Petroleum Investment Company (IPIC) of Abu Dhabi owns 64% of the company, with the remaining 36% owned by OMV, the leading energy group in the European growth belt. Borealis provides services and products to customers around the world in collaboration with Borouge, a joint venture with the Abu Dhabi National Oil Company (ADNOC). Therefore, Borealis and Borouge produce several million tonnes polyolefins every year, and the capacity will increase due to Borouge 3 plant, which will enable a combined capacity of up to 8 million tonnes. [1, p. 6]

1.2 Borealis in Finland

Borealis Polymers Oy operates in Kilpilahti, which is an area of about 1,300 hectares near Porvoo centre. In this area, there operates about ten companies and many smaller contractor companies. The biggest operational company in Kilpilahti is Neste's oil

refinery. Kilpilahti employs about 3,500 people. Borealis Polymers Oy produces plastics raw materials – polyethylene and polypropylene, and also base chemicals – phenol, acetone and olefins (ethylene, propylene and butadiene). These are used to produce everyday life products such as pipe systems for water, gas and sewage, storage, medical, food and transportation packages. Borealis Polymers Oy in Kilpilahti, Porvoo employs approximately 920 of which 500 in day and 420 in shift work. In Finland as much as 70% of Borealis Polymers products is exported either as bulk or packed products. Borealis Porvoo's Managing Director is Mr. Ismo Pentti and Location Leader and Plant Availability & Turnaround Manager is Mr. Hannu Luoto. [1, p. 14-19]

The first Borealis' plastic plant in Porvoo, a low-density polyethylene (later LDPE) was started up in 1972, and its capacity is 140.000 tonnes/a. LDPE film is used for packaging materials, wire, cables, board coating and medical applications. Polypropylene (later PP) plant was started up in 1988, and its capacity is 220.000 tonnes/a. PP application areas are, for example pipes, thin wall packaging products, caps and sheets. Polyethylene (later PE or PE2) plant was started up in 1995, and the plant's capacity is 255.000 tonnes/a. The products are bimodal polyethylene polymers, and they go to pipe, wire and cable and film applications. At polyolefin site there is also a plant called Boremix Compounding which produces different pipe, wire and cable coating and adhesion applications. [1, p. 20-23 and 26-29]

The olefins unit was started up from the ethylene plant in the year 1971 and within a few years a butadiene plant (1973) and propylene plant (1977) were started up. Their capacities are 390.000, 25.000 and 230.000 tonnes/a, respectively. The products are intermediates of chemical industry, which are used as feedstock in the production of, for example PE, PP and styrene-butadiene latex. The olefins unit requires extra focus on safety due to the substances used in the process. Olefins are easily flammable gases. [1, p. 30-31]

The phenol and aromatics unit was started up from benzene (1978). Cumene and phenol units were started up in the year 1981. Capacities for the benzene, cumene, phenol and acetone units are 150.000, 245.000, 185.000 and 115.000 tonnes/a, respectively. The phenol unit was expanded in 2007 to increase capacity to its present capacity. The end-products are phenol and acetone, which are used as raw materials, for example, in

the production of some special plastics and fixing agents. As much as 90% of the aromatics products are exported. [1, p. 24-25]

There is also the Innovation Centre in Porvoo which includes a laboratory, a pilot plant and other activities. The Innovation Centre focuses on catalyst and process research, patents and immaterial rights, technology transfer, catalyst business, PO business support and projects & operations support. The Innovation Centre in Porvoo is also doing a lot of co-operation with both in Finnish and international universities and other research institutes. Borealis Business Academy (later BBA) is also a part of the Innovation Centre, and it offers a wide range of trainings for Borealis' employees. [1, p. 32-33]

Materials Handling has a currently around 60 employees, and their key areas are packaging, loading and dispatching services of the four Borealis Porvoo PO plants. Their area includes 126 silos with the capacity of 25,000 tonnes and storages with totally 34,000 tonnes of storage capacity. Materials handling has three bagging lines and three octabin lines, and their total annual customer dispatch amount is as high as over 20,000. [1, p. 37]

2 History of learning and teaching

Learning is combining new information and something that is already processed. Also prior experiences do affect learning as learning is also connected to emotions. It is studied that a human being learns by using different senses. During the history people have studied human learning. For example, famous philosophers, like Socrates (469-399 B.C.), Plato (427-347 B.C.) and Aristotle (384-322 B-C.) had their debates about learning already over 2000 years ago. Their outcome was that people learn best depending on the desired goal, and they also had different approaches regarding learning as an event. The approach of these three Greek philosophers was rather different than, for example, what the Romans thought about learning. The Romans had an opinion where the meaning of life was more practical (for example building roads) and the method of teaching was vocational. That can be considered as the early stage of modern teaching. [2, p. 1]

Later on (in the 12th century), the Roman Catholic Church had a major role in teaching people in Europe. It had its school system, which included even universities. The teaching method was mainly transmission-based where the priests transmitted the information to the people and much memorization and repetition was needed. This is a very basic model of teaching, and still many of the classroom teaching is done by teacher transmitting information to the student. [2, p.2]

The liberal and more human-based learning was introduced during the 15th and 17th centuries, the Renaissance era. Thought of freedom, for example, was introduced and fought for by the philosophers. Also during these centuries it was presented that, for example, mind and body are separate from each other (Rene Descartes 1596-1659). One of the most ground breaking theories of teaching was introduced by the philosopher Jean-Jacques Rousseau (1712-1778), whose idea was to shape the education for the child. [2, p. 2]

The scientific study of learning began during the 19th century and one of that times' most known psychologist was Charles Darwin. He also studied how people learn by objective tests. Later on in the 20th century, debates about human learning have taken place between behaviourists and cognitive psychology. Behaviourists had their focus on behavioural learning, like through trial and error whereas cognitive psychologists' opinion about learning was that human brain constructs the bits of learned information based on all the senses. A few decades afterwards, the approach for learning was considered as individual and integrated to individual's life. It was also discovered that there are many aspects that affect learning, such as environment. That is why, for example, Montessori and Steiner schools were founded in the 19th and 20th centuries. They focus on learning, for example, with music and art. [2, p. 5]

Today's school system has many similarities to the hundreds-of-years-old basic elements of learning, but the methods are changing continuously. Modern learning theories highlight the cultural role and other influences on experience about how people construct knowledge about new information. It is also important how the knowledge is structured in the brain and it also affects how the new information that is being "saved." However, not all the learning is being similarly put into the brain due to different types of processing and performance of the learner. Learning creates interac-

tions, and it changes the physical structure of the brain. That is why it may sometimes be hard to remember something even though it is once learned. To get the ideal learning there are some basic key elements that have a great matter. [2, p. 8-10]

The environment plays a big role in learning. There can be added or removed different stimuli depending on the task that is being taught. When learning can occur in an environment where it is possible to use more senses, learning is often more effective. The environment has to be modified to suit for the desired outcome. Due to that basic fact, the teaching technologies have developed to create more and more simulations about teaching environment. Pictures, sounds and lights and their combinations have a big influence in learning. Thanks to the invention of the computers and all the possibilities computers have offered, the sky is the limit in developing environments. [2, p. 11]

Associations, feelings and emotions affect the way that an individual can draw connections between new and something that he has previously known or experienced in the brain. The feelings and assumptions have a huge effect on learning and will determine if it becomes a positive or negative experience. Even though emotional intelligence can be taught so that the individual can develop one's abilities to recognize and manage emotions to solve conflicts, to motivate oneself and to persevere in the face of difficulty. Also culture and social situations have impact on learning. What is valued and experienced at home, inside the community or school classroom do affect learning. The social aspect about how to communicate, roles between teacher and students, expectations and ideas of what is right and wrong all do play their role in learning. [2, p. 11-12]

3 Multimedia as a tool for supporting and enhancing learning

There are numerous of ways to create environments in order to create the best environment for a specific task. Multimedia is an excellent way to deliver data for the learner. What can be considered as multimedia? Data that is visualised and may contain audio is multimedia. In education this has made self-studying possible as the ma-

terial can be viewed at any time and the traditional classroom teaching can sometimes be fully or partially replaced. [3, p.1-2]

Multimedia delivery system consists of basically three components, which are hardware (computer), software (program) and the content. The user goes through the created material in order to learn the content. The form of multimedia material has changed due to development of equipment. Some decades ago audio was played and pictures could be shown separately, but computers have enabled better and more creative ways of showing material. Studies have been made about how to get the best learning outcome from different types of content and how to utilize them. [3, p.3-4]

Rapid development of multimedia systems' major driving forces has although probably been entertainment business. Games and other applications has been a model for simulators and so on. Nowadays computers' performance is outstanding compared to for example what the situation was 10 years ago. Then video or complex sound files could cause computer to reach its performance limit and crash the file, whereas today smartphones can play almost any content fluently. It can be said that multimedia has landed among the society due to reasonable prices of the equipment. [3, p. 3-4]

3.1 Some key elements to involve into multimedia content

In order to obtain the wanted outcome for a computer-based or a traditional classroom session, the material has to be designed to serve the topic. Teaching or instructing is manipulation of the environment to promote learning. It can be said that "manipulation" consists of two elements, which are instruction that creates the learning environment and the goal of the environment is to promote experiences inside the learner and its outcome is learning. The outcome can be tested in order to study the quality and depth of learning. It has been studied that a well-structured and narrated multimedia learning that includes animated pictures and audio can get better learning results compared to text or audio material. Learning was tested by retention and transfer, meaning that in retention the learner could repeat the content or remembers what was displayed whereas transfer shows more deep learning and the learner could for example

explain the content with their own words and answer questions related to the content. [4, p. 30-35, 5, p. 31-32]

A well-planned learning content can be summarized as the five c's:
Correspondent – Corresponding illustrations and text segments are presented near each other on the page.
Concrete – The text and illustrations are presented in ways that allow for easy visualization.
Coherent – The presented material has a clear structure (e.g. a cause and-effect chain).
Comprehensible – The text and illustrations are presented in ways that are familiar and allow the learner to apply relevant past experience.
Codable – Key terms used in the text and key features of the illustrations are used consistently and in ways that make them more memorable. [5, p. 36-37]

These simple elements apply both for multimedia or almost any teaching format and should be carefully considered when creating the material. Teaching itself has been previously following the principles such as assessment, workload and choice. These are more like transactional perspective reflecting and deep approach. Both in multimedia and traditional classroom teaching, the facilitation skills are also important as virtual learning environments can consist of group exercises and the risk for passive participation is always present. Therefore, the teachers are being pushed to rethink their educational principles and methodology in the era of Internet. [8, p. 66-69]

4 Types of multimedia learning

4.1 Distance learning

When a participant takes part in a teaching session via computer and not via the physical session itself, it is called *distance learning*. It might be streamed live, so the time to participate is synchronized. The material presented might be video from the training and the participants joining online can often only listen and not be active. This is anyway an excellent tool for sharing lectures around the Globe with those who are not

able to enter the physical session. The quality of the filmed material is important in order to deliver for the participant. Internet connections need to be effective enough to play live stream. There might also be arranged a distance training without any actual physical session. Then the trainer can speak from home office or anywhere where the required equipment is at hand. There might also be some activating tools for the distant learner such as chat to provide question, polls for the trainer to collect opinions or answers and so on. This type of learning is widely used in conferences. Basically distance learning is defined as "learning from distant." [14, p. 129-135]

4.2 ELearning

The term comes from an electronic learning that utilizes digital technologies. *eLearning* is kind of an umbrella term that covers web-based training, online training and the list goes on. *eLearning* can be a filmed lecture or it can be an edited high quality package that contains complex decision making tests and simulations. Internet has become a traditional way to share data as it enables access from any computer that has the access. It has basically unlimited capacity for storing information. Internet accesses have developed to become extremely fast within the last two decades so that almost any data can be opened within seconds. Internet is an extremely good way of storing electrical material because it is not limited for specific computers and locations. Companies can also limit the access so that it might only be available for internal network. That is often done for safety reasons. Hackers are always a threat for material that is widely shared and confidential material should be properly protected. [16]

4.2.1 Virtual Classroom

Virtual classroom is a variant of *eLearning*, and it still is the most familiar form of *eLearning* programs. This form of *eLearning* is an excellent supporting tool for distance learning. Many universities have even grades for totally web-based trainings. The *virtual classroom* platform enables the distant learner to utilize places to download papers for review and commenting, web conferencing tools for group assignments and to complete some tutorials as well. [7, p.3]

4.2.2 *Rapid eLearning*

Rapid eLearning is a tool for those who need to create eLearning material without high-end computer skills and the term is dated back to 2004. The term can also be a definition for a short training session that has only a small amount of learning objectives (later LO). Rapid *eLearning* is also a good tool that reduces time to actually edit the course material. In order to use the term '*rapid eLearning*' there are some guidelines to be filled. The course should be built up in maximum of three weeks and on some simple platform, such as Microsoft Power Point should be used as a tool. Course assessments should be simple as well as feedback and tracking functions. Going through the learning module should not take more than one hour. [9]

eLearning trainings, that are built with this variant are created by one person, workload is often counted in weeks instead of months. This enables the company to rapidly response to some needs inside the organization. It is often easier to utilize the knowledge of the existing experts inside the company. Administrative operations are easier to manage within *rapid eLearning* than traditional *eLearning* packages as there are not so many functionalities and the evaluation is rather simple. There are although some risks when using *rapid eLearning* technique. This enables almost everyone to create *eLearning* course material, so an inexperienced trainer can create not so successful content from technical point of view. [9]

4.2.3 Mobile learning

The term *Mobile learning* refers to the device that the learning content is being viewed. It doesn't bind the learning action in any specific location as mobile devices are small, wireless and easy to carry. Mostly *mobile learning* or *m-learning* can be considered to be utilized within informal material but also it can be connected to *virtual classroom* model. The form of *mobile learning* material must be created so that mobile devices are able play the file. There are also some thoughts about the sensitivity of mobile devices as the connections might be lost at some locations. *Mobile learning* differs from traditional *eLearning that* mobile devices are often experienced as "just-in-time" devices and therefore the learning experiences can be described with words "personal, informal, private, spontaneous, bite-sized and portable. These do not academically de-

fine mobile learning but they are some aspects that affect the learning experience. [7, p. 3-4, 10, p. 10-14 and 19, p. 2-3]

M-learning is constantly changing and new forms of teaching and utilizing technology are being found. Many subjects can be taught by complex multimedia content as mobile devices are developing to be more and more computer-like in performance. They might have in-built cameras that enable recording videos and publishing them with mobile software. Also the affordable prices of mobile devices have enabled technical development in developing countries and therefore it has increased their connectivity to the world and therefore knowledge. Evaluation of *mobile learning* course can although be often seen as a challenge. This comes from facts that it is challenging to create suitable techniques to gather, analyse and present evaluation, especially if evaluation is also done with mobile devices instead of PC. [10, p. 15-20]

Some disadvantages in *m-learning* are that cellular phones and small personal digital assistant (PDA) have small screen size so their ability to display data is limited. Also their small keyboards are putting some limitations for typing text. Memory size and battery life are also some concerns in mobile devices when utilizing *m-learning*. Solutions have been offered and they are mostly technology development-based such as projecting from small screen on to wall by an in-built projector. Small keyboard could be replaced with a virtual keyboard and charging needs for batteries could utilize methanol fuel cell technology (developed by Toshiba). [11, p.4]

4.2.4 Creating, viewing and sharing data in *eLearning*

In order to create any content for an *eLearning* course coding a simple *eLearning* required lots of computer skills and it was a huge effort that could require a whole team. Nowadays the technologies have become available for consumers and almost anyone can create their own *eLearning* material. One good and simple example for that could be Microsoft Power Point slides that can easily be made as a package and shared online. After the material is created, it comes to the publishing phase where it is shared to the public.

Distributing to the public is a phase that must be considered carefully before actions are taken. It must be clear that how widely and for whom is the content shared in order to prevent spread of confidential material. On the other hand the material should easily reach its audience. There are two types of distribution: informal and formal. Informal distribution typically covers informative tutorials and guides and learning is not tested or the participant's progress is not followed. Often this kind of material does not include much sensitive material and spread of this kind of material is wide. In formal distribution the course material is more sensitive and tracking of learning must be done in order to know how well the participants learn during the session. Many companies might have some mandatory courses that must be taken during the implementation for the work. This kind of courses can be for example safety related and Borealis has many of the contractor's trainings available in *eLearning* format. [16]

Technically, in order to view the material, some software requirements need to be filled. Flash player is not always available for mobile equipment such as tablets and smartphones so many of the sharing and publishing is nowadays often done in HTML5. Before Adobe launched Flash Player, almost any *eLearning* course required an installed program in order to show the content so this has made eLearning content viewing more accessible. [16]

4.2.5 Advantages of *eLearning*

There are many areas that can be taught in an *eLearning* session. For technical trainings the subjects are often theoretical and sometimes finding concrete examples and clarifying flowcharts etc. could be hard by just reading text and trying to follow pictures. When animation is added and the material is narrated to match the audio the learning environment changes crucially. The flowchart can be easily followed by the reaction taking place and by simultaneously listening to the trainer's voice. When an *eLearning* course is created some time must be reserved to pick up the relevant data and editing the material, recording speech and fine-tuning the whole package. But once a satisfying package is created it is easy to share and view. The trainer doesn't have to book classrooms, which saves company's money. Trainees don't need to re-

serve their schedules and travel costs are saved. Every trainer taking an *eLearning* course is getting similar information and it is similarly presented. An exact duration for the course can be provided and the material is carefully chosen to cover the area.

eLearning is a very suitable form of teaching small amounts of basic level information. In Borealis for example many of the safety-related trainings are available for Borealis employees as a repetition course. These kinds of courses are for example Phenol and Aromatics safety course which must be taken once a year. Repetition of a high quality material is not requiring much of effort for the participant and training can be taken when needed. BBA offers a very basic-level eLearning courses for example Borealis materials and business units. These *eLearning* are an excellent way of familiarizing with Borealis products and end-use of Borealis' plastics and base chemicals. *eLearning* material can easily be updated and re-published if some of its content change during the time.

There are some measurements for calculating the benefits of *eLearning* packages. One of the most common measures is called return of investment (ROI). Also a study (The effects of Internet-Based Instruction on Student Learning) was made by Dr. Scott B. Wegner, Dr. Ken C. Holloway and Edwin m. Garton in the year 1999 showed that there was no significant difference in completing Internet-based program or traditional class-room trainings. Training method in Internet-based training was *virtual classroom* type extended with traditional e-mail, fax and telcos. [18, p. 99-105]

Traditional roles between teacher and student in classroom training are being different-ly experienced in *eLearning* training. The teacher in *eLearning* is being considered more as an instructor and the person who creates the learning environment whereas the student can be considered as a worker. The instructor provides resources and the role is more assisting than perhaps a traditional auctorial teacher. This change can be considered as development of learning and teaching. This change must be made in order to implement successful web-based training as the only contact between the instructor and the trainer is the Internet and training platform. [18, p. 104]

4.2.6 Disadvantages of *eLearning*

Although *eLearning* is an excellent tool for delivering information for big masses there are some disadvantages. First concrete challenge is the lack for direct answers for the participant's questions. E-mail addresses can be provided and questions can be answered afterwards but a classroom training session offers the possibility to answer questions directly. Also if some topic is not easily understood some clarifying is often needed and in a classroom this can easily be done. In an *eLearning* course the learner can play the slide again but if the message still stays unclear this might frustrate the learner and further content of the session might not open as well. [14, p. 294]

If a very complex topic is created as an *eLearning* material it might need some extra care for animations and providing more interactive activities in order to serve its goal. This needs a lot of work in the creation phase and a lot of computing and even artistic talents. Borealis is lacking the resources to produce *eLearning* courses even though many topics are asked to cover with *eLearning*. Editing by its most simple way is also time-consuming as the material must be professional and also some modifications to the data itself might be needed afterwards. [15, p. 112-114]

4.2.7 Building and launching excellent *eLearning* course material

Before any concrete content is created for an *eLearning* course it is important to identify the needs for specific courses and to find the correct approach for the content. It is important to analyse both the learners and the task. One of the key elements for proper planning phase is to characterise the learner's profiles. Task analysis contains considerations about determine the depth of the material and level of detail. After analysis –phase the next step in creating a successful *eLearning* is to properly design the material, meaning that instructional objectives should be written. A tool that can be used for this is called learning objective (later LO). LO is a small manageable bit of information "that can be taken as stand-alone unit" [6, p. 292]. Also design –phase includes selections of instructional activities and media elements.

When the first draft material is being produced, the course gets its form and questionnaires are put into the material. Then the content can be reviewed by an expert and modifications according to experiences should be done. The next phase is so called formative evaluation where a small group of testers go through the material in order to find weakness in it. It is important to select the learners from different levels of knowledge, so that the material is revised from all three types of learners, which are high achiever, average learner and low achiever. The learners testing session should be observed as their behaviour during the *eLearning* course can give some ideas on how to improve the material. [6, p. 290]

After the first test group has done testing and the improvements from those tests have been made would be beneficial to test the content with a slightly larger scale. The trial group should be selected by learning profiles that match for the targeted learner's profiles and the group size should be around ten persons. After test group has done its tests the administrative side of the package should also be tested and the course evaluations should be done in order to make sure that the course delivers data properly. Then the last fine-tuning can be done in order to produce the first version of the *eLearning* module. All the analyses should be done from the previous tests and given feedback, the instructional activities and media elements should be revised before launching the module. [6, p. 291]

4.2.8 Borealis' layout requirements for the material

After basic layout elements are correct, the other visual fact must be considered. These are pictures, text placing and animations. Slides should not have too much text but not too many pictures either. Finding the correct personal way of presenting things might be a challenge but this can also vary from topic to another. If some of the viewers' attention must be attracted, using animations might be a good solution. That is why animations should not be used too much in order to prevent the material to become busy. For example when clarifying a polymer structure it might be good to show in an animation how the polymer is being formed and what substances are used. Also some condition requirements can be displayed simultaneously. The whole picture gets

clearer when the learner can see the process in a chronological order. Same rules apply for reactions that apply in Borealis plants in order to produce the products.

After the slides are created it is important to write down the audio speech. The trainer must keep in mind that the participant might not have any experience on the topic beforehand and that they see only the material presented on the slides. When the text is spoken and recorded, reading the same text that is written on the slides is not the perfect way of representing the topic. Some little deeper information can be provided if the topic will benefit from it (see Appendix 3 for course feedback). Also the speaker should have a clear and natural way of speaking so that the material is easy and enjoyable to follow. Also some background music or voice can be added if there is a need to cover pauses in the speech. Audio must be edited to remove all extra noises and mistakes in the speech.

When the material is recorded the animations are often timed to match the speech. By then audio-visual learning can be enhanced and the stimulating effect of simultaneous speech and animation can enhance memorizing the content later. Some interactive applications are a good bonus to be added in order to keep the participant focused during the session. A good length of one slide is around one minute and amount of slides can vary from 15 to 30 slides. If much speech is recorded per slide the listener might struggle in following the material and become passive. When creating e-course material, it should be considered that some participant activation should be made during the course. The activation forms are questions that can consist of multiple choices, right or wrong etc. Adobe Captivate 7 offers a wide range of question choices. Also some pictorial tests can be made out where the learner is asked to pick up the right or wrong ones from a series of pictures. Some of participant activation can be carried also without tests; on the other hand, testing the listener is also an excellent way to record the outcome and to evaluate learning actions. [15, p. 112-113]

4.2.9 Different types of courses for different segments inside Borealis

There are plenty of different departments and different work tasks inside Borealis but one aspect binds them all: constant training in their own field. It is impossible to mention only one method of training which would be the best, but there are many very functional ones. Classical class room trainings are always something that will be needed as it enables personal contact and conversation. In such cases where the trainer or the expert would have to travel, this creates a lot of costs (travel tickets, hotels, extra salaries etc.) and those can be avoided by arranging an online training session. Borealis has some teleconference (later Telco) –programmes in use and they enable contacting Borealis' personnel without boundaries as Borealis is an International company. The programmes in use are for example Lync, where you can for example share your computer screen and Arcadin for telcos. Trainings can also be arranged so that employee can access traditional classroom training via telco.

Due to Borealis' production environment a lot of process charts and different molecular pictures are shown in eLearning materials as well. It is very important to explain these properly as some participants may not have previous chemical knowledge background. On the other hand, there may also be participants whose daily work is based on chemistry only. Both these sides are a challenge as an eLearning becomes boring if the topic is too hard or easy for the participant.

4.2.10 Implementation of *eLearning* in companies

As a company decides to go for *eLearning* –type of employee teaching it means in most cases that reconstructing roles for faculty must be made. These changes are often expected to be rapid and knowledge about *eLearning* content procurement is expected. Those, who have previously been instructors, become *eLearning* material producers, programmers and instructors. This statement is strict and not a good example of action. Those, who engage themselves for *eLearning* material producing, should be networked and properly noticed in the company. They should be able to undergo systematic process called Instructional Development Methodology. [14, p. 292]

4.2.11 Administration of *eLearning*

When the company has made the decision to create their own *eLearning* courses in order to train their employees it is important to find the recourses also to administrate the materials. This contains often person(s) that give training support and they keep track on the number of courses taken and other statistics. Also following the staff's progress in learning is one of administrative actions in *eLearning* as well. Learning management systems (LMS) is a tool for administrating teaching and learning processes. Knowledge Management (KM) focuses on an integrated approach to identify, capture, retrieve and share enterprises information. These two measurements are partially aiming to the same goal and it can be said that learning is a peer to knowledge. Also updating the *eLearning* material takes time and effort and should be noticed when creating e-materials as the information and level of knowledge is increasing all the time. [6, p.288-289 and 11, p. 405-407]

5 Future of *eLearning*

The form of teaching and training has developed during the times and the most rapid changes have been during the time that computers have been used to support human activities the last decades. Using technology to support and enhance learning is a very natural way of developing trainings and this is more of an educational than technical issue. Without doubt, the key driver is technical development that makes everything possible. By creating more complex environments with developed technology, the learner can experience the situation with a simulator. Technical industry uses a lot of simulators as there are a lot of hazardous chemicals and equipment that operates with high temperature and pressure so the ongoing process itself contains a lot of risks if the conditions are changed. By simulators new conditions can be tested without any danger for human or nature. Process and human safety have been one of the driving forces to ensure process simulators in technical industry as well as the financial point of view.

5.1.1 Micro videos as a form of *eLearning*

Not all the technical trainings are presented by concrete simulations of the process, but *eLearning* sessions are a big part of trainings in the future as well. The form of eLearning can develop to almost anything, and now, for example, micro videos have become one very popular way of representing content. Video can deliver almost any content from moving picture to still photos or text to high quality coded animations. The key elements are, however, to compress the material in as short clip as possible in order to maintain the interest of the viewer. A Company named Grovo that provides micro videos for trainings has studied what percentage of the viewers are actually viewing, for example, a 10 minute long video. The result was that one to three minutes was the most effective duration for a well-narrated video clip in order to maintain viewer's interest. The company provides also a platform for the video-based *eLearning* sessions, and user management for managers to enrol participants and follow their personal development by different segments. There are many advantages in such a short clips: the viewer doesn't have to engage themselves for a too long period at once. When one big area has been put into smaller pieces the opportunity of better learning is increased and the learner can continue from where they left. [17]

5.1.2 Social networks and social media in *mobile learning*

Free Internet-based video sharing platforms and Social network has made it possible for everyone to share their own videos, but not all the content is unprofessional even though such platforms ensure that everyone can create also educational material. Will the amount of available data confuse users and make it hard to find the right data?

Social network makes people's personal Internet behaviour more active, and they actually learn also many useful things concerning their jobs as well, whether it is computer skills or social skills. Social network can be time consuming and there is a large amount of irrelevant data. It is often seen as only 'outside work' tool, but it could also be used to join specialists together that share same job-related issues and sharing their thoughts and knowledge could create great inventions. It is easier to communicate with people that you have been somehow in touch with than with a person who is

just a name on the phone book. There are however many challenges with social media that concerns business and relationships. What material can be shared without revealing confidential material or insulting anyone? Is it acceptable inside the company to use social media in work and would there be separate profiles and platforms for that? [12, p. 407-410]

Learning is personal, but work and private learning is hard to tell apart from each other as the same person can use their skills in both private and working life. Learning as an event is either formal or informal learning meaning that formal learning is, for example, an arranged training session and informal learning can take place when you ask help from your colleague or call helpdesk to solve your problem. Informally learned skills can also be learned on some informal platform such as YouTube. It does not, however, mean that the skills would not be appreciated or that they would be meaningless. [7, p. 3]

5.1.3 Integrated *eLearning ecosystem* as a future of *eLearning* content management

The amount of information can be a future challenge for learners. Information is being split into small very detailed packages and finding the link between different areas might be hard. Managing all the data and finding the right trainings should be integrated into one system in order to find the information most effectively. It has been suggested that a digital ecosystem could solve many of these problems inside a company. A digital ecosystem means a self-organizing digital infrastructure, aimed at creating a digital environment that is being networked and supporting cooperation, information and knowledge sharing and development of technologies. A digital ecosystem can consist of software components, applications, online services, business models and almost any other information that the company has strategies of. [20, p. 113-114]

An *eLearning ecosystem* that is being fully developed can also include human-resources-integrated features, meaning that an employee can see their benefits and personal information regarding, for example, their health, personal knowledge development and competencies regarding their career. Also administrative prospect of

eLearning ecosystem makes it easier to follow ROI, KM and LMS as the nature of the ecosystem is more systematic. [20, p. 115-116]

6 Summary

This thesis focused on defining learning and teaching strategies, gathering and analysing training feedback in Borealis and producing a concrete training material for Borealis internal trainers utilizing a *rapid eLearning* form. The training feedback was gathered from Internet surveys that were opened after every training session within one year (2013-2014) and analysed in the summer 2014. Average grades for trainers were calculated and overall trainer grades were calculated for both internal and external trainers. Also written feedback was gathered, analysed and communicated for the Borealis internal trainers. Improvement proposals for trainings and training equipment were also made. The results showed that BBA offers high quality trainings and trainers are highly appreciated talented experts.

Research on learning and teaching regarding multimedia learning and defining types of *eLearning* was also widely made. The advantages and disadvantages of Internet-based training were studied and proposals for training content were made from both contextual and technical point of view. Also administrative and some resource prospects were considered and proposals were made. Borealis will benefit from this thesis from many points of view as this thesis has gathered some basic elements of different types of eLearning, utilization of content and also some future considerations for employee training. Successful planning of new course material can also give many concrete approaches for BBA for the future.

The research of human learning, environments, methodology and different training feedback has been interesting and highly motivating. Examining the creation of an *eLearning* course from different points of view has given me a lot of new ideas considering my future within the field. Also the amount of information in this field is wide, and finding the material for the concept was a good learning experience. Finding correct references was a challenge and many of the articles were about ten years old, but they were chosen as the information has not been changed. It has also been interest-

ing to find out how theory meets practise within BBA eLearning creation to study and the common "rules" for eLearning content creation.

7 References

[1] Borealis Porvoo Finland. 2015. 45 p.

[2] L. Hammond, K. Austin, S. Orcutt and J. Rosso. 2001. How People Learn: Introduction to learning theories. 21 p.

[3] T. Morris. 2012. Multimedia Systems: Delivering, Generating and Interacting with Multimedia. 26 p.

[4] R. E. Mayer. 2009. Multimedia learning Second edition. 52 p.

[5] R. E. Mayer. 2001. Cognitive Theory of Multimedia Learning. 48 p.

[6] T. Govindasamy. 2002. Successful Implementation of e-Learning Pedagogical considerations. Internet and higher education 4/2002. p. 287-299

[7] E. Wagner, Adobe Systems. 2006. Delivering on the Promise of eLearning. 9 p.

[8] D. R. Garrison and T. Anderson. 2002. E-learning in the 21st century a framework for research and practise. 51-71 p.

[9] Trivantis Corporation Inc. 2015. What is rapid eLearning? http://trivantis.com/what-is-rapid-e-learning. Read July 15th 2015.

[10] M. Ally. 2009. Mobile learning: Transforming the Delivery of Education and Training. 297 p.

[11] T. Georgiev, E. Georgieva and A. Smrikarov. 2004. M-Learning – a new stage of E-Learning. International Conference on Computer Systems and Technologies – CompSysTech'2004 P. IV.28-1- IV.28.5

[12] by M. Chatti, M. Jarke and D. Frosch-Wilke. 2007. The future of e- learning: a shift to knowledge networking and social software. Int. J. Knowledge and Learning vol.3, Nos. 4/5 2007. P. 404-420

[13] A. de Grave, Borealis. 2011. Science TCM&TCL Implementation in Innovation & Technology Business group. 48 p.

[14] J.L Moore et al. 2011. E-Learning, online learning and distance learning environments: Are they the same? Internet and Higher Education 14. P. 129-135

[15] R. E. Mayer. 2002. Aids to computer-based multimedia learning. Learning and Instruction 12 (2002) P.107-119

[16] Articulate Global, Inc. 2015. What is E-Learning? https://community.articulate.com/series/getting-started/articles/what-is-e-learning. Read July 20th 2015.

[17] J. Pierre, Grovo Learning Inc. 2015. Teleconference July 9th 2015.

[18] Dr. S. Wegner, Dr. K. Holloway and E. Garton. 1999 The Effects of Internet-Based Instruction on Student Learning. JALN vol. 3, Issue 2. 1999 P. 98-106

[19] Attwell and Pontydysgu. 2007. Personal Learning Environments –the future of eLearning? 8 p.

[20] L. Uden and E. Damiani. 2007. The Future of E-Learning: E-Learning eco system. Inaugural IEEE International Conference on Digital Ecosystems and Technologies 2007. P. 113-117